

1 **WHAT IS CLAIMED IS:**

1 1. A method for recording segment execution times in a processing system,
2 the method comprising the steps of:

3 recording a timestamp corresponding to the beginning of a segment to be
4 executed, the recording step being conducted through a firmware operation; and

5 updating the timestamp with an elapsed segment execution time, the updating step
6 being conducted through a plurality of hardware based operations, wherein the plurality of
7 hardware based operations are executed without firmware interaction.

1 2. The method of claim 1, wherein the recording step comprises writing a first
2 memory address into a globally accessible timestamp address register.

1 3. The method of claim 1, wherein the updating step comprises:
2 reading the contents of a second memory location designated by an update address
3 register;

4 writing the contents of the second memory location into a location value register;
5 adding the elapsed segment execution time to the location value register contents;
6 and

7 storing the location value register contents to the second memory location
8 indicated by the update address register.

1 4. The method of claim 3 further comprising the steps of:

2 clearing the elapsed segment execution time stored in an elapsed time register; and
3 setting a second value in the update address register with a first value from a
4 timestamp address register.

1 5. The method of claim 1 further comprising the step of initializing hardware
2 components of the processing system, the initializing step further comprising the steps of:

3 disabling timestamp assist functions;

4 setting an elapsed time register to an initial value;

5 writing an initial address into a timestamp address register;

6 writing the initial address to an update address register; and

7 enabling the timestamp assist functions.

1 6. The method of claim 1 further comprising the step of invoking an interrupt handler
2 if a second segment is received for processing during the updating step.

1 7. The method of claim 6, wherein the step of invoking an interrupt handler further
2 comprises:

3 generating an interrupt signal in a memory controller;
4 determining if the updating step is still in process;
5 determining if a timeout has been reached if the updating step is determined to still
6 be in process;
7 restarting the updating step for the second segment; and
8 clearing the interrupt signal from the memory controller.

1 8. A method for recording segment execution times through a central processing
2 unit, the method comprising the steps of:

3 writing a first determined memory address into a timestamp address register with a
4 firmware based operation;
5 reading contents of the first determined memory address into a location value
6 register with a hardware based operation;
7 adding an elapsed time value corresponding to a segment execution time to the
8 contents read into the location value register to create an updated value, the adding step
9 being conducted with a hardware based operation; and
10 storing the updated value to the first determined memory address with a hardware
11 based operation.

1 9. The method of claim 8, wherein the reading step comprises:

2 reading a memory location from an update address register in a timestamp assist
3 logic module; and
4 writing the memory location into the location value register in the timestamp assist
5 logic module.

1 10. The method of claim 8, wherein the adding step comprises:

2 reading the elapsed time value from an elapsed time register in a timestamp assist
3 logic module, the elapsed time value corresponding to an elapsed time between a start of a

4 segment execution and the step of reading the elapsed time; and
5 adding the elapsed time value to the contents stored in the location value register.

1 11. The method of claim 8, wherein the storing step comprises:
2 reading the contents of a location value register; and
3 writing the contents read from the location value register to the first determined.

1 12. The method of claim 8 further comprising the steps of:
2 generating a segment processing interrupt when a second segment is received for
3 processing during one of the writing, reading, adding, and storing steps;
4 transmitting the segment processing interrupt to a processor;
5 interrupting segment processing; and
6 invoking a timestamp busy interrupt handler.

1 13. The method of claim 12, wherein invoking the timestamp busy interrupt handler
2 comprises:
3 determining if the updating step is still in process;
4 determining if a timeout has been reached if the updating step is determined to still
5 be in process;
6 restarting the updating step for the second segment; and
7 clearing the interrupt signal from the memory controller.

1 14. An apparatus for recording segment execution times in a processing system, the
2 apparatus comprising a memory controller in communication with a central processing
3 unit and a memory, the memory controller comprising:
4 at least one control register;
5 at least one address register; and
6 a timestamp assist logic module,
7 wherein the memory controller is configured to conduct timestamp update
8 operations autonomously from the central processing unit.

1 15. The apparatus of claim 14, wherein the timestamp assist logic module comprises:
2 an elapsed time module;

- 3 an update address register; and
- 4 a location value register.

1 16. The apparatus of claim 15, wherein the elapsed time module comprises an elapsed
2 time register having an updated elapsed time value stored therein.

1 17. The apparatus of claim 14 further comprising:
2 a processor bus in communication with the central processing unit and the
3 memory controller for communication therebetween;
4 a memory bus in communication with the memory and the memory controller for
5 communication between the memory controller and a plurality of memory locations in the
6 memory; and
7 a system bus in communication with the memory controller, the system bus being
8 configured to connect one or more additional devices to the memory controller.

1 18. The apparatus of claim 14, wherein the control register is configured to generate
2 an interrupt signal when the timestamp assist module receives a second segment for
3 processing while a first segment is currently processing, the interrupt signal being
4 transmitted to the central processing unit via a system bus.

1 19. A memory controller for recording segment execution times in a complex
2 processor system, the memory controller comprising:
3 a timestamp assist logic module;
4 a timestamp control module;
5 a timestamp address module; and
6 wherein the memory controller is configured to communicate with a memory in
7 order to execute a timestamp update operation corresponding to a particular segment
8 execution time, the timestamp update operation being conducted without interaction with
9 an operating system of the complex processing system.

1 20. The memory controller of claim 19, wherein the timestamp assist logic module
2 comprises:
3 an elapsed time module;

- 4 an update address module; and
- 5 a location value module.

1 21. The memory controller of claim 20, wherein the elapsed time module comprises a
2 device for calculating and storing an elapsed time value corresponding to the time elapsed
3 between initial segment execution and completion of segment execution.

1 22. The memory controller of claim 20, wherein the elapsed time module comprises an
2 elapsed time register having an updated elapsed time value stored therein.

1 23. The memory controller of claim 19 further comprising:
2 a processor bus in communication with the operating system and the memory
3 controller for communication therebetween;
4 a memory bus in communication with a plurality of memory locations in the
5 memory and the memory controller for communication therebetween;
6 a system bus in communication with the memory controller for communication
7 between the memory controller and additional devices in the complex processing system.

1 24. The memory controller of claim 19, wherein the timestamp control module is
2 configured to generate an interrupt signal when the timestamp assist logic module receives
3 a second segment for processing while a first segment is currently processing, the interrupt
4 signal being transmitted to a central processing unit.